Conception, representation & mediation in participatory land planning projects: 3D physical models artefacts

Pierre Maurel, Yann Bertacchini

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Introduction

The concept of sustainable development and its related principles, in particular public participation, changed dramatically in France the way of developing and implementing public policies for spatial planning. It progressively shifted from sectorial, technical and centralized approaches to more holistic, participatory and deliberative approaches. Individual citizens and social groups in interaction are becoming more numerous and diversified, as well as the *habitus* and social representations. Thus, getting mutual understanding and a share vision of the territory becomes longer and more complex. In this context, the informational and communicational dimension of these widened socio-technical processes turns to play a central role (Bertacchini et al 2006). The emergence of a process of territorial intelligence requires more fluent exchanges of information between the participants and greater confidence in the information exchanged. To face such a challenge, one of the possible solutions is to introduce mediating objects (Vinck 2006) able to help formulating and making understandable by other participants different perspectives and kinds of knowledge available among the actors network. But the introduction of innovations in normative territorial planning processes is already in itself a challenge.

Relying on the Diffusion of Innovations (DoI) Theory (Rogers, 2003) and an Information and Communication Tools (IC-tools) uses theory (Proulx 2005), this paper aims to focus on the 3D physical models that have been used to support a participatory land planning project for the Thau territory. This paper will describe how this innovation has been introduced into the territorial intelligence process, the making process itself and the characteristics of the models, the uses initially planned as well as the observed uses and effects (cognitive, procedural, relational, local capacities).

Case study application : a territorial intelligence process in action

An experiment has been launched in the framework of an operational research study integrated in the participatory spatial planning process of the Thau territory. This territory is situated in the Hérault department in the south of France, near the city of Montpellier, the regional capital.

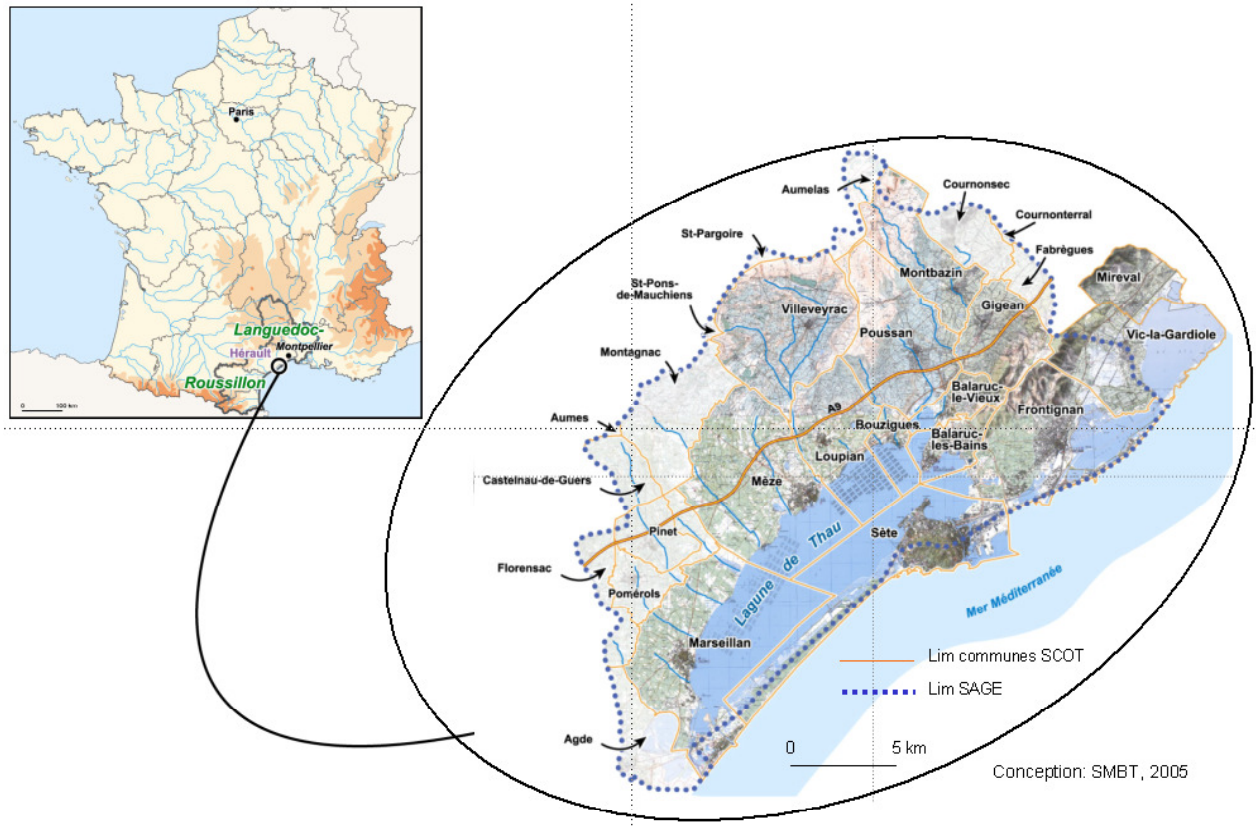

Figure 1: Location of the Thau territory

To reinforce integrated coastal zone management (Vallega, 1999), the local authorities have decided in 2005 to implement simultaneously two new planning tools, a SCOT (territorial dimension) and a SAGE (water dimension). These public policies instruments are driven by the Syndicat Mixte du Bassin de Thau (SMBT) which acts on behalf of the two intercommunal cooperation structures (EPCI) that represent all the municipalities of the territory. In order to anticipate the implementation of the SAGE and the SCOT instruments, the SMBT is also encouraging local stakeholders to translate sustainability principles into action in their professional practices. For instance, the Villeveyrac council situated in the northern part of the Thau territory has decided in 2007 to develop a local agenda 21 in order to reinforce its rural identity in a peri-urban context.

A detailed description of the Thau territory, it's governance system and the participatory process has already been presented (Maurel 2008). To support this approach, different animation and facilitation methods combined with several information and communication tools have been used or are still under development (Maurel and Roussillon, 2007). Some of these tools, based on Internet technologies, are particularly sophisticated. Others remain extremely "rudimentary" from a technical perspective but are equally useful and effective in the emergence of a process of territorial intelligence.

We will focus in this paper on one of these "rudimentary" tools, the 3D physical scale model.

The 3D physical scale-model as communicational artefact: towards a revival ?

A comparative analysis of various spatial representations shown that 3D physical scale-models were presenting intrinsic properties suitable for synchronous, face to face and bidirectional communicational processes and were not requiring heavy decoding tasks (Maurel 2001). 3D models turn out to be very powerful and user-friendly communication tools. They can support a variety of collaborative processes that are extremely interactive (free expression of local knowledge, results communication, scenario building, etc.) and multi-sensory (vision, hearing, sense of touch).
That kind of artefacts has been widely used in the past centuries, in particular by military to prepare the defence or the siege of strategic sites (Warmoes 1997). It is currently also used in developing countries to support participatory development projects with local people. Very detailed methodologies are now available to make and to use such models (Rambaldi, 2002).
There is, however, in France at this time a clear preference for the use of digital or virtual representations. Physical 3D scale-models are rarely used, except for urban or large infrastructures planning projects, but more as marketing tools than for participatory design.

Diffusion of 3D physical scale-models in the Thau territory planning process

Several actors have contributed to introduce 3D physical scale-models in the participatory planning process of the Thau territory and other related activities (fig 2).

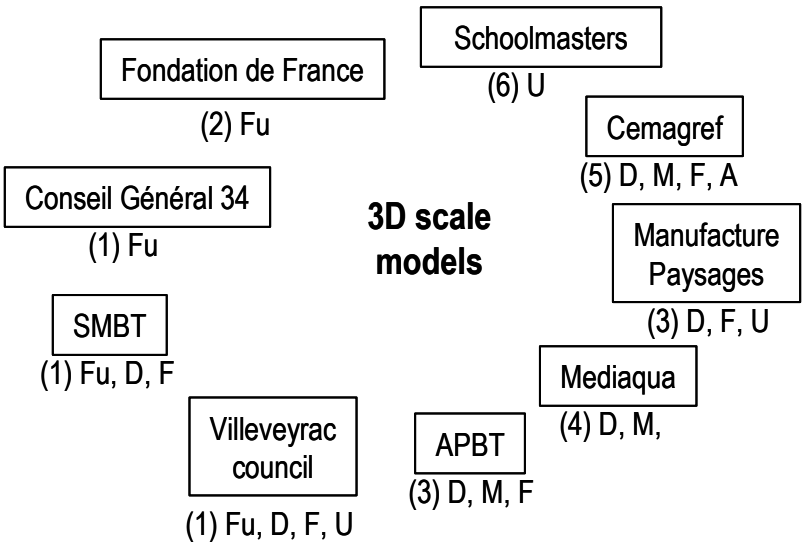

Fig. 2: Actors network involved in the 3D scale-models innovation process
Type of actor: (1) Local authority, (2) Foundation, (3) NGO, (4) Private Cie, (5) Research, (6) Education
Role in the process: Fu: Funding, D: Design, M: Making, F: Facilitation, U: Use, A: Assessment

To date, four different scale-models have already been manufactured. These models have been used during different events (SCOT technical group workshops and public meetings, educative sessions) with various audiences (elected officials, professional representatives, NGOs, public at large, schoolboys).
Their main characteristics are described in the following table.

N°	Scale	Size (m)	Area	Layout	Accessories
1	1:25 000	1,6 m x 0,8	Thau territory	White magnetic paint	- Vertical support
2	1:25 000	1,6 m x 0,8	Thau territory	Coloured geographical features (administrative limits, land use, roads, rivers)	- Coded small items for individual real life places and activities
3	1:50 000	0,8 m x 0,5	Generic river basin	Coloured land use areas	- Filling up bulb - Small coloured items for components of urban water system (aqueduc, tank, intake, treatment plant, …)
4	1:5 000	1,6 m x 1,6	Villeveyrac district	Coloured geographical features (administrative limits, land use, roads, rivers, irrigation network)	Horizontal support Transparent plastic sheet with land use

Table 1: Main characteristics of the 3D scale-models

The following timeline provides an overview of the different phases as well as the concerned actors for the design, the making and different uses of these four 3D scale-models.

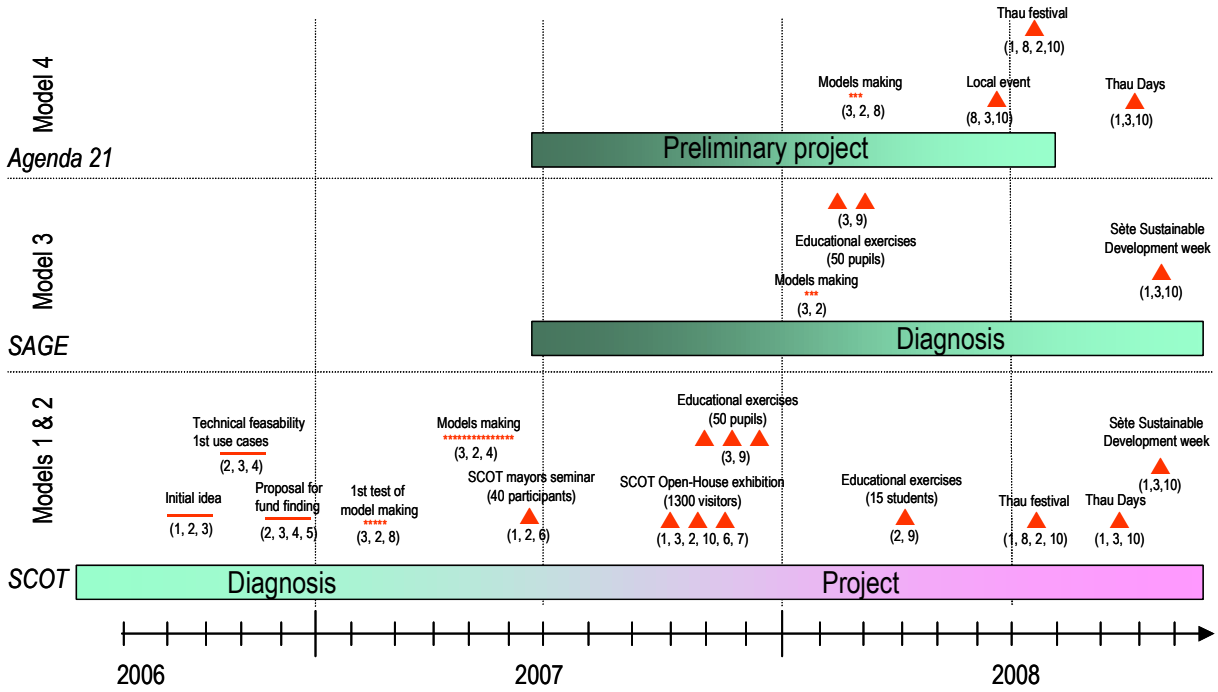

Figure 3: Timeline describing the 3D scale-models development process
1: SMBT 2: Cemagref 3: NGO (Galapians, CPIE, Mediaqua) 4: NGO Manufacture des Paysages 6: Mayors 7: Local stakeholders 8: Villeveyrac council 9: Education (scholar students, teachers) 10: Public at large
----- Preliminary phases ***** Making phases ▲▲▲ Use phases

If we analyse the diffusion process from the Diffusion of Innovations theory, Rogers distinguishes five stages through which an innovation passes: knowledge, persuasion, decision, implementation and confirmation (Rogers 2003).

Knowledge phase: In our particular case, three actors were knowing the potential of 3D scale-models and understanding their functions. They played the role of change agents defined by Rogers. These agents were: 1- A local NGO leader who was already using basic 3D models for educational purposes in the Thau territory. 2- Another NGO, situated closed to the Thau territory, familiar with the use of 3D objects to raise public awareness of urban planning challenges. 3- The Cemagref researcher involved in the design of the Thau participatory process, who was aware of the experiences carried out in developing countries (Rambaldi, 2002) and who recently investigated spatial representations properties.

Persuasion and decision phase: The SMBT technical agents in charge of the planning project were already favourable to innovative approaches, including public participation, and used to deal with geographical reasoning. Their clearly played the role of initial change aides defined by Rogers as the ones who complement the change agents, by having more intensive contacts and more trustworthiness credibility with decision makers (here, the group of mayors involved in the SCOT process). The SMBT facilitated preliminary meeting between the NGOs and the Cemagref researcher and convinced the mayors about the interest of making 3D scale-models.
The three initial technical actors worked together to prepare a proposal for a national call for tender in the field of participatory land management in order to get additional funding. The first proposal was rejected for administrative reasons but the second one submitted in 2008 was successfully accepted.

Implementation phase: These three initial actors then cooperated for the design and the making of the models 1 and 2. These two models have been used in 2007 for several events related to the SCOT process (mayors seminar, a two month open house exhibition and a serie of educational activities). The uses of the models during the open house exhibition are detailed later in this paper.

Confirmation phase: Positive feedbacks from these first uses allowed then to pass through the “confirmation” stage described by Rogers, which corresponds to a reinforcement of the innovation in the social system. Several new actors asked for using these models or for producing new ones for their own activities. For instance, the representatives of Villeveyrac district in the SCOT process appreciated the two first 3D models and decided to contract with the NGOs already mentioned to make another 3D model covering the Villeveyrac district area. This new model will be used to support participatory activities related to the implementation of the local Agenda 21. It has already been displayed in 2008 during three popular events, raising the visibility of the Villeveyrac council initiative towards sustainable development. The SMBT and the local NGO are also benefiting from this visibility.
The local NGO also produced a 3rd scale model of a generic river basin with the technical assistance of the Cemagref researcher. To date, this model has been mainly used for several educational activities with local schools to raise awareness in the field of river basin and water management. The SMBT agent responsible for the SAGE process also played the role of change aides for the diffusion of this 3D model since he is very favourable for cooperating locally with the educational system.

3D scale-models making process seen as a socio-technical process

The design of technical objects is in itself a dynamic socio-technical process in which designers, users and environment interact. Then, cultural norms and conventions that have been incorporated into objects work up to guide their uses (Akrich, 1987).
For example, the partners of the first Thau scale-models have contributed with their own ideas, skills and values to co-design these artefacts. From a technical point of view, the making process has been adapted compared to the one described in the manual already mentioned (Rambaldi, 2002): Cork material was preferred to corrugated carton board for ecological considerations, contour lines were directly displayed with a video projector at the right scale on the cork sheets instead of using carbon paper, scale-models were made by local NGOs and a researcher instead of inhabitants for socio-cultural reasons.

According to Proulx (2005), designers base their activity on the representations that they have of the virtual users and they translate them into affordances. For instance, in our case, it was considered as fundamental to create an artefact that will encourage the targeted users to think and reason at an inter-district level because they were seen as people who used to think very locally. For that reason, the two first 3D scale-models have been designed to cover the whole Thau territory and the individual districts limits have not been represented on the models.

According to the same author, values, moral and political dimensions are also incorporated into the technical objects. In the Thau case study, the innovators were sharing the same values concerning the way of carrying out territorial projects: vision and choices driven by the sustainable development principles, bottom up approach, linking traditional decision and participatory methods involving all stakeholders and ordinary citizens, transparent access to understandable information, mixing expert and local/tacit knowledge, involving the youngest through educational activities, avoiding digital divide between connected people and the others. Within the range of tools used in the Thau planning project, the choice of “rudimentary” 3D scale-models rather than high-tech digital and dynamic 3D representations of the territory were definitively driven by these values. The same reasons influenced the design of accessories and socio-technical environments of the 3D scale-models. For instance, the 3D models were not placed under a plexiglas protective device but were kept opened and completed by symbolic and movable items for interactive exercises. Another example concerns semiologic choices to represent phenomena on the 3D models. Thau territory is subject to intense demographic pressures leading to rapid urban sprawl and these phenomena are perceived from very different perspectives. If they are seen as positive by some elected people or groups of interest, the designers of the 3D models considered them as dramatic for ecological and social reasons. They decided to represent urban areas in black, as an oil slick, in order to reinforce the negative dimension of urban sprawl phenomenon and to focus participants’ attention on it. They also used the red color (associated to “danger” in our society) to produce an interactive map of urban sprawl dynamics between 1944 and 2020 that was displayed on the vertical white 3D model (model n°1) and which really caught the attention of participants.

Analysis of some uses of the 3D scale-models

We have chosen to detail here how the 2nd scale-model has been used during the touring open-house event designed to present the SCOT diagnosis to the general public from August to October 2007.
The two-month exhibition was presented in 7 of the 14 municipalities in the Thau territory, and lasted one or two weeks including the week-end at each location. Each event was preceded by a public meeting chaired by the local mayors assisted by the SCOT project manager. Next, SMBT technicians successively “facilitated” the open house event. A staff member of the NGO that had made the models organized several visits by schoolchildren. A total of 1 300 people attended the public meetings and the exhibition.

Here is a brief description of the informational and communicational support system that has been imagined by the SMBT and the local NGO to present the results of the SCOT diagnosis.
The exhibition itself included 25 posters organised around 6 topics, an interactive map of urban sprawl dynamics between 1944 and 2020 displayed on a vertical white 3D model (model n°1), a urban planner game to lay out a new plot, a GIS on a laptop to display SMBT geographic data upon request, and at least one interactive exercise with the 2nd 3D scale-model (see below a description of this exercise).

Main land use features were already painted on the 3D model: towns, main roads and main rivers, lagoons and the sea, the SCOT and the watershed limits. Small coloured items were also produced to represent several individual real life places or activities such as lodging, work place, shopping centres, sporting and cultural facilities and different means of transport (car, bus, etc.). Visitors to the exhibition were asked to pinpoint these items on the 3D model in order to represent their footprint on the territory in terms of housing, transportation, shopping and leisure (figure 4).

Fig. 4: Use of the 3D scale-model in the open-house exhibition for the SCOT diagnosis

Direct observations made during the exhibition and interviews with the facilitators revealed different uses and effects of this 3D model. Some of these findings were expected by those who produced the 3D models, some other uses emerged during the interactions between the facilitators, the visitors and the physical artefacts of the exhibition. We now present six uses of the models that correspond to our main findings.

- Cognitive use: for most of the visitors, Thau territory still was a blurry concept they had heard about through the local media or by listening to the technicians and mayors speeches. The 3D models enabled them to acquire a more accurate representation of the territory, both its natural (perimeter, relief, land use, hydrography) and human dimensions (towns, roads).

- Second cognitive use: the interactive exercise that consisted in positioning small coloured items on the 3D models helped the visitors to link their real-life spaces (mainly made up of local places and transportation axes) with the much wider Thau territory. This exercise also enabled them to visualize their footprint on the territory. The accumulation of coloured items pinpointed by previous visitors helped them discover the diversity of real-life spaces and their cumulative effects in terms of housing, transportation and services. A real learning process was going on in their minds: Thau territory not only started to exist, but they also were deeply embedded in it.

- Third cognitive use: Several authors have already shown that technical objects with a representational function could act as partners in the cognitive activity of those who used them (Norman 1993, Millerand 2002). They can alleviate the cognitive tasks of attention, reasoning, memory insofar as they take over a part of human cognitive activity. They can also replace different cognitive tasks (involving representations and manipulation of symbols) by a direct perception (Quéré 1997). In our case, the 3D scale-models clearly played this role by supporting during the SCOT diagnosis exhibition the process of communication between agents with different frames of reference (i.e. mainly between the SMBT technicians and visitors). By presenting the physical space of the Thau territory, the 3D scale-models were offering visual grasp

points in the discourse and gestures of the other person to better locate places and understand territorial phenomena that were verbally expressed.

- Relational use: when the 3D model was used at the beginning of the visit, it helped to establish contact between the facilitator and the visitor. During the positioning exercise, the hitherto anonymous visitor revealed to the facilitator his daily life spaces, his practices and his preferences, allowing an interpersonal discussion to start, which helped to create an atmosphere of confidence for the rest of the visit.

- Procedural use, this use derived from the previous one: the interaction mediated by the 3D model enabled the facilitator and the visitor to start a discussion about several territorial issues (housing, urban sprawl, employment, traffic jams, sport and cultural facilities, environmental impacts, etc.). In this case, the 3D model was used by the facilitator to direct the visitor to the exhibition panels for an in-depth discussion about these important issues.

- Last use, which can be qualified as indirect or secondary, was related to the relational capital of the Thau territory. Indeed, several people from different institutions developed a strong partnership to carry out this project based on 3D models. They worked together as a real team to improve the initial idea, to find technical and procedural ways to make the models themselves, to design interactive exercises and finally, to put all these innovations into practice during the exhibition. These activities enabled a relational network based on trust, reciprocity and specific innovative skills to be extended and strengthened. This latent richness could be reactivated later for the benefit of the territory.

Discussion

This paper aimed to describe how the 3D scale-models innovation was introduced into the Thau territorial intelligence process, the making process itself and the characteristics of the models, the uses initially planned as well as the observed uses and effects.

Results shown that the diffusion process of the 3D scale-models was respecting the Diffusion of Innovation Theory proposed by Rogers.

One of the most interesting conclusions to date is that 3D scale-models communicational artefact can definitively help to connect technical representations of the territory with real-life places as perceived by the inhabitants, thus facilitating the dialogue between spatial planners and ordinary citizens. They also helped to strengthen trust between technical staff from the leading institution, local NGOs and the public at large. All these aspects have positive effects on the emergence of a territorial intelligence process.

Numerous studies have shown that even if designers strongly guided uses of communicational artefacts, there could be from users gestures of diversion of these uses originally planned, or even totally new uses (Millerand 2002). In our case, results to date indicate that the observed uses of the 3D scale-models were widely anticipated by the designers, and predetermined through their design itself, their immediate surrounding environment and the instructions of use proposed by the designers or the facilitators.

However, some uses originally planned have not been observed yet, especially those imagined to facilitate technical or political meetings of traditional decision makers (mayors, government and local authorities technical staff, stakeholders representatives).

During the next stage of the SCOT and SAGE processes, we believe that the 3D scale-models could facilitate the dialogue concerning the territorial political project supported by elected officials. Depending on the intensity of use of these models, they might turn to become widely shared symbolic representations of the Thau territory. All that contributes to a process of gradual emergence of territorial ownership.

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Brief sum-up of the author's CV

Pierre Maurel has an engineer degree in agronomy and a DEA (diploma for advanced studies, MSc+) in quantitative geography with an extensive experience in remote sensing, GIS and data infrastructure. He is employed by Cemagref, Montpellier, France, as a research scientist since 1987. He is involved both in applied research, training, pedagogical engineering and expertise activities both in France and in foreign countries. His current field of interest is to develop and/or assess Spatial Information and Communication tools and methods for the integrated management of territorial and environmental projects.

He was involved between 2002 and 2006 as investigator in the SYSCOLAG research program to contribute to a Web metadadata service for the Integrated Management of Coastal Zone in Languedoc Roussillon, France; as a WorkPackage leader on information and communication tools in the HarmoniCOP project between 2002 and 2006 (public participation for the Water Framework Directive); as project leader and researcher between 2001 and 2006 for the research program *Consultation, Decision and Environment* funded by the French Ministry of Environment Affairs; as project leader and researcher since 1998 for the *SIRS digues* project (Information System for dike management in river flood plains); as researcher and advisor in a territorial participative planning process since 2006 for the Thau Mediterranean coastal territory, France; as researcher in the Intermed project since 2008 for the development of e-technologies to support on-line deliberative processes in the field of environmental management.

He is also responsible for several short courses for postgraduate students and for professional: *Administration de données localisées* (geo-located data management), *Spatial planning and territorial diagnosis* and *Use of Geographic IC-tools to support Public Participation*.

He has started a PHD in 2007 in the field of Information and Communication Sciences applied to participatory spatial planning processes.

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After several years in the French Navy where is served into, he joined the commercial and industrial world, as junior then senior in marketing, administration and international field at first step, in small and medium companies, furthermore in big ones.

In 2001, it was appointed by European scientific commission as expert.

For the research manner, he is leading doctoral researches and thesis in Territorial intellgence within applications in several countries.

From march of this year, he is assistant of mayor of Fréjus (medium town of south France) in charge of new technologies, sustainable development, policy strategy, prospective etc..also and concilior of frejus-st-raphael agglomeration.